

TEMNOSTOMA BOMBYLANS AND RELATED SPECIES
(SYRPHIDAE, DIPTERA).

By R. C. SHANNON.

The species of *Temnostoma* are comparatively rare, wasp-like flies which inhabit dense forests and damp woodlands. The larvae bore in fallen logs and are characterized by a heavily sclerotized terminal segment which protects them from predatory insects which may invade their galleries. The adults are found only during the spring months. In low-land forests, they frequent shaded situations in which decaying logs occur. In cooler mountainous country, however, they seek the warmth of the open sun-exposed peaks.

In color and size, the flies resemble the yellow jacket and *Odynerus* wasps. Although their antennae are short, they habitually simulate the long antennae of the wasps by extending their fore legs and vibrating them.

The present account deals with the species which resemble the *Odynerus* wasps (i. e., those with a single yellow crossband on tergites 2 to 4) namely, *trifasciatum* Robertson, *greenei*, new species, *barberi*, new species, *balyras* (Walker) and *obscurum* Loew. This grouping of the species is a superficial one; another, based on structural differences, is given in the key.

Since 1878, various attempts have been made to synonymize the last three of the above named species with the very similar European form, *bombylans*, as well as with one another. Other attempts have been made to restore their specific status but a certain amount of confusion still exists in the literature.

The present review of the species is based on a study of the material in the U. S. National Museum; European material of *T. bombylans* (kindly loaned by Dr. C. H. Curran); an examination of the type of *obscurum* in the Cambridge Museum of Comparative Zoology; the C. W. Johnson collection in the Boston Society of Natural History; information on the type of *balyras* in the British Museum (received through the cooperation of Dr. John Smart) and material collected by the writer in North Carolina, 1936, and in Virginia and New York, 1939.

The pertinent data obtained from the literature are here summarized in chronological order. It should first be mentioned that the diverse opinions regarding the species have usually resulted from inadequate material, inaccessibility of the type specimens and the questionable value of certain characters given in the original descriptions, particularly that of the facial tubercle. This character proves to be a reliable one that is, however, confined to the males of only certain species.

Only publications dealing with the specific status of the species are cited here; faunal lists, etc., which merely include the names of species are omitted.

T. greeni, new species, has not been recorded previously and therefore is omitted in the following discussion.

1805. Fabricius (Syst. Antli., 189) described *Milesia bombylans* from the Pyrenees. (The genus *Temnostoma* was erected by St. Fargeau and Serville (Encyl. Method., 10) in 1828 and in 1910 Coquillett (Proc. U. S. Nat. Mus. 37, 612) designated *bombylans* as the genotype.)

1849. Walker (List III, 577) was the first to record a species of this group from America, giving it the name of *Doros balyras*. Although misplaced generically, the description, based upon a female from Trenton Falls, New York, suffices for its proper recognition. The salient characters given are: Antennae and mid and hind tarsi bright yellow, abdomen with four slightly arched yellow bands.

1864. Loew (Cent. V, 35) noted that his species, *T. obscurum* (type, a male from Saskatchewan, Canada) differed from the *bombylans* of Europe by the presence of a small facial tubercle.

1878. Osten Sacken (Cat. N. A. Diptera) lists *obscurum* as a synonym of *balyras*.

1886. Williston (Synopsis N. A. Syrphidae, 250) considered the facial tubercle of *obscurum* as a variable character and listed both *balyras* and *obscurum* as synonyms of *bombylans*.

1901. Robertson (Canad. Ent. 33 : 285) stated that his species *trifasciatum* (3 males and 3 females from Illinois) differed from *bombylans* in that the female has only three instead of four yellow abdominal bands.

1913. Barber (Proc. Ent. Soc. Washington, 15, 151) recorded a number of rearings of *bombylans* from wood-boring larvae, noted that several types of larvae existed in his material and suggested that possibly as many as four species of this group occur in the eastern United States. The adults which he reared prove to be *T. balyras*. Possibly his material contained larvae of the *Vespula*-like species of *Temnostoma* as well.

1922. Malloch (Ent. News, 33 : 278) after receiving information from Pezzi regarding the European *bombylans*, stated that this species was probably restricted to the Old World. He had, however, two American species which he discovered differed in the color of the abdominal hairs. One of these he correctly identified as *trifasciatum*. Meanwhile, Banks had informed him that the type specimen of *obscurum* had yellow abdominal hairs and in this respect it agreed with Malloch's second species, which he accordingly identified as *obscurum*.

1925. Johnson (Proc. Boston Soc. Nat. Hist., 38 : 84), however, considered that Malloch's *obscurum* (nec Loew) was conspecific with *balyras*. (This proves correct and is the first published recognition of *balyras* as a valid species since 1886.) On the other hand, Johnson resurrected the synonymy of *obscurum* with *bombylans* and with it included a previously

unknown species, the first record of a fourth species in America. The latter is described below as *T. barberi*.

1930. Curran (Bull. Amer. Mus. Nat. Hist., 61 : 72), with European specimens of *bombylans* at hand, concluded that this species does not occur in America. The commoner New York species he considered might prove to be the *Doros balyras* of Walker, but being doubtful of the generic status of *balyras*, he decided that it should be called *obscurum* Loew until the type of *balyras* could be critically examined.

1933. Metcalf (Ann. Ent. Soc. Am., 26 : 1) has given excellent figures and descriptions of the larvae and adults of *balyras* and *bombylans*. The latter proves to be the same species which Johnson had confused with the true *obscurum* when he synonymized the latter under *bombylans*; i. e., the species described below as *T. barberi*.

The synonymy may be conveniently summarized as follows:

Temnostoma bombylans (Fabr.) 1805.

T. bombylans Malloch, 1922 (European material).

T. bombylans Curran, 1930 (European material).

Temnostoma balyras (Wlk.), 1849.

T. balyras Osten Sacken, 1878 (in part).

T. bombylans Williston, 1886 (in part).

T. obscurum Malloch, 1922 (in part).

T. balyras Johnson, 1925.

T. obscurum Curran, 1930.

T. balyras Metcalf, 1933.

Temnostoma obscurum Loew, 1864.

T. balyras Osten Sacken, 1878 (in part).

T. bombylans Williston, 1886 (in part).

T. obscurum Malloch, 1922 (in part).

T. bombylans Johnson, 1925 (in part).

Temnostoma trifasciatum Robertson, 1901.

T. trifasciatum, Malloch, 1922; Johnson, 1925; Curran, 1930.

Temnostoma, new species, described below.

T. bombylans Johnson, 1925 (in part).

T. bombylans Metcalf, 1933.

During this study, certain new and more useful characters were found which facilitate the correct identification of the species. The results confirm Malloch's and Curran's independent conclusions that *bombylans* does not belong to the American fauna, and agree with Malloch's recognition of *trifasciatum* and Johnson's identification of *balyras*. Further, it is shown that *obscurum* is a valid species and that the form which Johnson confused with *obscurum* and *bombylans* and which Metcalf called *bombylans* is a new species.

Detailed descriptions of all of the *Odynerus*-like (or *bombylans*-like) species are given below.

KEY TO THE SPECIES OF TEMNOSTOMA.

1. Metasternum bare; a pair of yellow spots in front of scutellum (sometimes faint or absent in *barberi*).
 Male: Narrowest width between eyes equal to the space between the upper ocelli; face with a small tubercle 2
 Metasternum pilose; males with eyes separated by a space distinctly less than that between the upper ocelli 4
2. Width of pollinose line along the occipital orbit (the post lateral eye margin) decidedly narrower than width of first antennal segment; antenna dark brown; all femora extensively black; abdomen with three yellow crossbands, black areas with black hairs. (Resembles *Odynerus leucomelas* wasps).....*barberi*, n. sp.
 Width of occipital pollinose line decidedly broader than width of first antennal segment: antenna, fore femora and mid and hind legs bright yellow; abdominal hairs chiefly yellow..... 3
3. Second and succeeding abdominal tergites bright yellow, each with black crossband. (Resembles the workers of yellow jacket wasps)..
Pictulum Williston
 These tergites blackish, each with a yellow crossband on the anterior half, the posterior portions becoming brassy posteriorly. (Resembles *Odynerus* wasps).....*greenei*, n. sp.
4. Abdomen black, tergites 2 to 4, usually 2 to 5 in the female, each with a yellow crossband; facial profile of male straight or gently concave. (Moderate size; length 11 to 15 mm.; slender flies resembling *Odynerus leucomelas* wasps).. 5
 Abdomen with additional yellow crossbands present on the posterior margins of these tergites; male with a small facial tubercle. (Larger, 13 to 20 mm., and more robust flies resembling the queens of the *Vespula* wasps)..... 12
5. Males 6
 Females 9
6. Face with a small tubercle; antenna and last two segments of mid and hind tarsi dark; yellow hairs predominating on the abdomen.....
obscurum, Loew. 7
 Face without tubercle..... 7
7. All femora black except extreme bases and apices; only two pairs of mesonotal spots; abdominal hairs black and brownish intermixed.
bombylans (Fabr.)
 Mid and hind femora on basal one-third or more yellow, at times entirely yellow; three pairs of mesonotal spots present..... 8
8. Last tergite with only coarse black hairs beyond the crossband; the abdominal crossbands broader than apex of hind tibia
trifasciatum Robt.
 Last tergite with only fine yellow hairs; crossbands narrower than apex of hind tibia.....*balyras* (Wlk.)
9. Fifth tergite with abscescent or no yellow crossband*trifasciatum* Robt.
 Fifth tergite with a conspicuous and uninterrupted yellow band 10

10. Yellow abdominal bands 2 to 4 practically straight, not attenuated at ends.....*obscurum* Lw.
All crossbands arcuate, their ends attenuated and curved backward.
11. Last tergite with yellow hairs.....*balyras* (Wlk.)
Last tergite with black hairs.....*bombylans* (Fabr.)
12. Yellow marking on transverse suture of mesonotum entire.....13
This marking interrupted, represented by two spots.....14
13. Femora yellow. (Resembles yellow jacket queens).....*excentricum* (Harris).
Femora extensively infuscated, at least the fore femur. (Resembles *Vespula rufa consobrina* queens).....*aequale* Lw.
14. Last black abdominal band with submedian interruptions, being reduced by three black spots, one median and one on each side.
(Resembles yellow jacket queens).....*alternans* Loew
This band with a median interruption. (Resembles the queens of *Vespula rufa consobrina*).....15
15. Abdominal pile black except along lateral margins.. *nipigonensis* Curran
Apical half of abdomen with yellow pile.....*venustum* Will.

DESCRIPTIONS OF SPECIES.

Temnostoma barberi, n. sp.

T. bombylans, Johnson (nec. Fabr.) Proc. Bos. Soc. Nat. Hist. 38 : 84, 1925.

T. bombylans, Metcalf (nec. Fabr.) Ann. Ent. Soc. Am., 26 : 1, 1933.

Male.—Ocellar triangle black with a yellow pollinose area below; space between eyes equal to that between the upper ocelli; frontal triangle broadly pollinose with a median shining black triangular area above antennae; antenna yellowish brown, face black, bordered by broad pollinose stripes which are a continuation from the pollinose area of the frontal triangle; a small facial tubercle present; width of the pollinose line bordering the post lateral eye margin much less than that of the first antennal segment.

Mesonotum black with a median pair of fine longitudinal grayish stripes on anterior two-thirds and four pairs of yellow spots, one pair on the humeri, one along the transverse sutures, one anterior to the post alar calli and one before the scutellum; the last two pairs are at times faint, occasionally absent; pleural black with a yellow spot on the mesopleura; metasternum bare (rarely one or two hairs present).

Legs: Fore coxa yellow, fore femur black, yellow at base and apex; fore tibia yellow basally, black beyond; fore tarsus black; mid femur black, yellow at base and apex; the tibia yellow on basal half, brownish beyond; first three tarsal segments yellow, last two darkened; hind femur with basal fourth and apex yellow, remainder black; tibia yellow on basal third and apex, remainder darkened; first two tarsal segments yellow, the last three darkened.

Abdomen black with three yellow crossbands, the first (on the second tergite) is nearly as broad as the length of the first tergite, the ends broader than the middle; the second and third fasciae (on third and fourth tergites respectively) with their ends sharpened posteriorly, thereby producing an arcuate effect to the bands; second and fourth tergites longer than broad, the third a little broader than long; all of the black areas of the abdomen with black hairs.

Wing: Anterior portion, above the fourth vein infuscated. Squamae white; halteres reddish yellow.

Female.—Front and face black with a yellow pollinose stripe extending from the level of the lower ocellus to the oral margin; facial tubercle absent; abdomen with four yellow fasciae; all of the tergites broader than long; otherwise similar to the male.

Length.—9 to 13 mm.; wing: 6 to 10 mm.

Type.—A male, U. S. National Museum No. 51913. Allotype in the collection of the Boston Society of Natural History. Paratypes, 4 males and 15 females, in both collections.

Type locality.—Highlands, North Carolina, in hemlock forest about 4,000 feet altitude, May, 1936 (R. C. Shannon). Locality of allotype: Jaffrey, New Hampshire, June (C. W. Johnson). Paratypes from Bar Harbor, Maine (Johnson); Livingston, Mass. (L. H. Taylor); Ithaca, New York (E. G. Anderson, Shannon); Mt. Hurricane, Essex Co., New York (Shannon); North East, Pa. (R. A. Cushman); Inglenook, Pa. (W. S. Fisher); Harrisburg, Pa. (A. B. Champlain, Fisher); Carlisle Junction, Pa. (Champlain); Ann Arbor, Mich. (Anderson). Also reported by Metcalf from Illinois.

Curiously this species apparently has not been collected in Maryland or Virginia although Barber may have had it represented in his larval material which was found in these States. Judging by the known records, it is chiefly northern in distribution.

Although *T. barberi* is very similar to *bombylans*, *balyras*, *obscurum* and *trifasciatum* in general appearance, its structural characters indicate that it is more closely allied to *greenei* and *pictulum*. In addition it possesses two characters which are peculiar to it, the very narrow occipital pollinose line and the sternites of the male are subquadrate in form. The other species mentioned above have the sternites distinctly broader than long.

Apparently only Johnson and Metcalf have recorded *barberi* but in both instances under the name *bombylans*. The male of the latter, however, has the eyes practically touching, lacks the facial tubercle, the sternites are decidedly broader and the cross-band on the second tergite is the narrowest of the three. The female of *barberi* is distinguished from the female of *bombylans* by the narrow occipital pollinose line and the bare metasternum. Finally, *barberi* is the only species among the *Odynerus*-like forms, aside from *greenei*, which shows a pair of yellow spots in front of the scutellum although they are at times faint or absent. (See also discussion under *obscurum*.)

The species has been named after Mr. Herbert S. Barber, who initiated my study of the group.

Temnostoma greenei, new species.

Male.—Occipital pollinose stripe bright yellow, about twice as broad as width of first antennal segment; narrowest distance between eyes a little greater than space separating upper ocelli; ocellar triangle black, a yellowish pollinose area below, followed by a black one; pollinose area on frontal triangle divided in two arms, each continuing down to the oral margin; median facial stripe black, much narrower at oral margin than below the antennae; a small facial tubercle present; antenna and arista bright yellow.

Four pairs of yellow mesonotal markings, one pair on the humeri, one on the transverse sutures, one in front of the post alar calli and one prescutellar; scutellum grayish yellow on post margin; side of thorax with a yellow stripe extending from the upper margin of the mesopleura to the lower one and onto the sternopleura.

Fore femur and basal fourth of tibia bright yellow, remainder of front leg black; mid and hind legs bright yellow.

First abdominal tergite shining black, the second with a basal black band followed by a broader yellow one which is nearly twice as broad at its ends as at the middle, posterior portion of the tergite black, gradually becoming dull brassy towards the posterior margin; third and fourth tergites with the yellow band nearly straight and of fairly uniform width, in other respects similar to the second except that the brassy color is a little more pronounced; abdominal pile chiefly yellow; all sternites distinctly broader than long.

Wing infuscated along anterior half, faintly so beyond the fourth vein; squamae whitish, halteres yellowish.

Length.—13.5 mm., wing 6 mm.

Type.—A male, U. S. National Museum No. 53444.

Type locality.—College Park, Maryland, May 17, 1936.

Named after Mr. C. T. Greene, the collector.

T. greenei is intermediate between *barberi* and *pictulum*. Although its color pattern is more pronounced than that of *barberi*, it does not equal that of *pictulum*. All of the yellow markings of the latter are brighter than those of *greenei*, particularly on the abdomen. In *pictulum*, the posterior margins of tergites 2 to 4 are bright yellow; there are, therefore, four strongly contrasting crossbands on each of these tergites. *Pictulum* in fact resembles the workers of the yellow jacket wasps while *greenei* approaches the *Odynerus* type of coloration.

Temnostoma bombylans (Fabr.)

Milesia bombylans, Fabr. Syst. Antli., 189, 1805.

Male.—Antenna dull yellow; facial tubercle lacking; the median black facial stripe broader than the adjoining pollinose ones; only two pairs of yellow markings present on the mesonotum, the humeral and the transverse suture pairs; mesopleura with a vertical yellow stripe; front leg black except extreme apex of femur and base of tibia; mid femur black except apically, tibia and first three tarsal segments yellowish, the last two dark brown; hind femur black except

extreme base and apex; tibia yellowish at apex and base, brownish between; the first three tarsal segments yellowish, the last two dark brown; metasternum pilose; abdominal tergites with fine intermixed brownish and black hairs, the yellow fasciae with their ends directed backwards, producing an arcuate effect.

Female.—Similar to the male except for the presence of the fourth abdominal fascia and in having all of the tarsal segments yellow; the last abdominal tergite with only black hairs.

Description based on one male and one female from Austria (in the collection of C. H. Curran).

T. bombylans has been reported from many European countries and from Siberia and Japan as well. Curran suggests that the "bombylans" of the Old World may consist of two or more species.

***Temnostoma obscurum* Loew.**

T. obscurum Loew, Cent. V, 1864.

T. balyras Osten Sacken (nec Loew), Cat. N. A. Dipt., 1879.

T. bombylans, of American authors (nec Loew).

Description of the type: Male—Occipital pollinose stripe as broad as the second antennal segment; the facial pollinose stripe which continues from the frontal triangle to the oral margin is broader than the black median stripe; a small facial tubercle present; antenna and arista brownish; mesonotum with a single longitudinal gray stripe which is as broad as the yellow area on the humerus; all the yellow thoracic spots (as noted for *barberi*) present save the pre-scutellar pair; metasternum pilose; last two segments of mid and hind tarsi darkened.

First abdominal tergite opaque black on basal half, shining dark blue beyond; the second with an opaque black band on the anterior margin, which is followed by an arched yellow one; this in turn is bordered by an opaque band and lastly a dark blue one is present on the posterior margin, this being the broadest of the four bands; third tergite similar to the second except that the yellow band is nearly straight and the posterior band covers the apical half of the segment; the fourth tergite likewise with a nearly straight yellow band followed by a very narrow opaque one, while the shining area covers the apical two-thirds of the tergite. All of the tergites broader than long with fine yellow hairs except that a few black ones are intermixed on the fourth; hypopygium with yellow hairs only; forceps about twice as long as broad. First sternite about four times as broad as long; width of the second about three times its length; the third and fourth each about two and one-half times as broad as long; venter entirely pale pilose.

Female.—Authentic females of *obscurum* have not, as yet, been recorded. A female in the Cambridge Museum of Comparative Zoology agrees very closely with the type male but the pollinose line along the occipital orbit is obscured by grease which prevents absolute identification. The color of the antennae and legs is the same as in the type and it also possesses the peculiar abdominal

coloration and pattern that is found in the type specimen, except that it has the yellow crossband on the fifth tergite, common to the females of this group.

The facial tubercle of the male and dark antennae and tarsal segments gives *obscurum* a superficial resemblance to *barberi* from which it may be distinguished by the broad occipital pollinosity, the pilose metasternum and the abdominal markings. The yellow abdominal crossbands are peculiar to *obscurum* in that the second and third are practically straight and of almost equal width throughout their entire length (the fourth band in the female above noted is likewise nearly straight and uniform in width). The facial tubercle of the male and the color of the antennae and tarsi separate it from *balyras* and *trifasciatum*. Moreover, the abdomen of the male is broader than in the other species, being very similar in form to the females of the group. Finally, aside from *balyras*, it is the only species of the subgenus with yellow hairs predominating on the abdomen.

Type and type locality.—The only authentic specimen known of this species is the type male in the Cambridge Museum of Comparative Zoology, from Saskatchewan, Canada (Endicott).

The female noted above was collected at Gold Rock, Rainy River District, Ontario, July, 1905. (H. H. Newcomb, ex collection of C. W. Johnson.)

***Temnostoma balyras* (Walker).**

Doros balyras Walker, List III, 577, 1849.

T. balyras Osten Sacken, Cat. N. A. Diptera, 1879.

T. bombylans Williston, Syn. N. A. Syrphidae, 1886.

T. obscurum Malloch (nec. Loew), Ent. News, 1922.

T. balyras Johnson, Proc. Boston Soc. Nat. Hist., 1925.

T. obscurum Curran, Bull. Amer. Mus. Nat. Hist., 1930.

T. balyras Metcalf, Ann. Ent. Soc. Amer., 1933.

The distinguishing characters of this species are: Antennae bright yellow; no facial tubercle; fore legs yellow at base and apex of femur and at base of tibia, remainder black; mid and hind legs yellow except that both femora are black except at base and apex and usually there is a broad, dark brown ring on the distal half of the hind tibia; metasternum pilose; abdominal pale bands rather strongly arched; abdominal hairs yellow.

Apparently the commonest and most wide spread species of *Temnostoma*, ranging from Ontario to North Carolina; also reported by Metcalf from Illinois.

Type.—In the British Museum.

Type locality.—Trenton Falls, New York.

***Temnostoma trifasciatum* Robertson.**

T. trifasciatum Robt., Canad. Ent., 33 : 285, 1901.

T. trifasciatum Malloch, Ent. News, 33 : 278, 1922.

T. trifasciatum Johns., Proc. Bos. Soc. Nat. Hist., 38 : 84, 1925.

T. trifasciatum Curran, Bull. Amer. Mus. Nat. Hist., 61 : 72, 1930.

Robertson noted only one salient character for *trifasciatum* in his brief description, namely, that the female has only three yellow crossbands on the abdomen. Not infrequently, however, there is a rudimentary band on the fifth tergite. Malloch used the color of the abdominal hairs which serves to distinguish both sexes from its nearest ally, *balyras* (Walker).

Male and female.—Facial tubercle absent; occipital pollinose line broader than width of first antennal segment; antenna bright yellow; fore femur yellow on basal half, darkened beyond except that the apex is yellow; remainder of fore legs black; mid legs bright yellow; hind femur and tibiae each with a dark preapical area, remainder of hind leg yellow; metasternum pilose; last tergite with only coarse black hairs beyond the crossband; width of the abdominal crossbands broader than apex of hind tibia.

Type locality.—Carlinville, Illinois. Also occurs in Virginia, Pennsylvania and New York.

A NEW SPECIES OF SIALIS (MEGALOPTERA, SIALIDAE) FROM KENTUCKY.

By LEE H. TOWNSEND,

College of Agriculture, University of Kentucky.

Ross¹ has recently published a taxonomic study, based on the characters furnished by the genitalia, of the nearctic species of the genus *Sialis*. These structures proved the best characters for separation of species. Ross made no attempt to homologize the parts of the genitalia but merely applied descriptive terms to them. The present writer has used the same descriptive terms. By referring to the drawings one can understand the location and relation of these parts.

Sialis nina, n. sp.

This species is in the *infumata* group having the terminal plate (fig. 2, t) produced only along the vertical axis. The male would run in Ross's key (l.c.) to the couplet with *velata* and *itasca*, but can be readily separated from these species by the convexity of the lateral plates, the different shape of the terminal plate, and the absence of a basal lobe on the genital hooks. The terminal plate is distinctly wider at the base than at apex, whereas in *velata* and *itasca* this plate is not widest at the base. The eighth sternite (fig. 5, δ) of the female is distinctive, being different from that of any other known female.

¹ H. H. Ross.—Studies of nearctic aquatic insects. I. Nearctic alder flies of the genus *Sialis* (Megaloptera, Sialidae). Illinois Natural History Survey Bul. 21, Art. 3, pp. 55-78, 1937.

Dr. H. H. Ross checked and approved all determinations used in this paper and to him the writer expresses sincere appreciation.